HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Soos Creek Coho Program
Species or Hatchery Stock:	Coho (Onchorynchus kisutch) Green River
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Green River Puget Sound
Date Submitted:	March 17, 2003
Date Last Updated:	January 23, 2003

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Soos Creek Coho Program.

1.2) Species and population (or stock) under propagation, and ESA status.

Green River Coho (*Onchorynchus kisutch*) - not listed

1.3) Responsible organization and individuals

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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

In addition to the WDFW station production, 600,000 fingerlings are transferred to the Muckleshoot Tribe at the Crisp Creek Hatchery, 550,000 unfed fry are transferred to the Muckleshoot Tribe at Keta Creek, 60,000 subyearlings are transferred to coop net pen projects,120,000 eyed eggs are transferred to the DesMoines NWSSC, 25,000 fish are transferred to the Seattle Aquarium and approximately 140 ,000 eyed eggs and fish are given to other local co-op projects .

1.4) Funding source, staffing level, and annual hatchery program operational costs.

Funding is provided through the State General Fund and Aquatic Lands Enhancement Account (cooperative projects).

1.5) Location(s) of hatchery and associated facilities.

Soos Creek Hatchery: Big Soos Creek (09.0072) RM 1, a tributary to the Green River (09.0001) at RM 33.5.

1.6) Type of program.

Integrated Harvest.

1.7) Purpose (Goal) of program.

Augmentation: The goal of this program is to provide harvest opportunity.

1.8) Justification for the program.

Coho will be produced at Soos Creek while minimizing adverse genetic, demographic or ecological effects on listed fish. This will be accomplished in the following manner:

1. Release coho as smolts with expected brief freshwater residence and time of release not to coincide with out-migration of listed fish.

2. Only appropriate stock will be propagated.

3. Mark all reared fish.

4. Hatchery fish will be propagated using appropriate fish culture methods and consistent with Co-Managers Fish Health Policy and state and federal water quality standards; e.g. NPDES criteria.

1.9) List of program "Performance Standards".

See below

1.10) List of program "Performance Indicators".

Performance Standards and Indicators for Puget Sound **Integrated Harvest** Coho programs.

Performance Standard	Performance Indicator	Monitoring and Evaluation Plan
Produce adult fish for harvest	Survival and contribution rates	Monitor catch and measuring survivals by periodical CWT data.

Meet hatchery production goals	Number of juvenile fish released - **600,000 on-station 350,000 tribs** **For other releases in watershed see Muckleshoot Tribal HGMP**	Estimating number of fish planted (weighing / counting fish), monitoring proximity to hatchery production goals, number released recorded on hatchery divisions "plant reports", data available on WDFW data base. Future Brood Documents.
Manage for adequate escapement	Hatchery and wild return rates Catch rates	Monitoring hatchery/wild return rates through trapping (at the hatchery or at weir), redd and snorkel surveys on the spawning grounds plus catch records.

Minimize interactions with listed fish through proper broodstock management	Total number of broodstock collected - **2,300**	Measuring number of fish actually spawned and killed to meet egg take goal at the hatchery. Hatchery Records.
	Sex ratios	Hatchery Records, Spawning guidelines
	Timing of adult collection/spawning - **October through November**	Start trapping prior to historical start of the run, continue trapping throughout the run, dates and times are recorded on hatchery divisions "adult reports", data available on WDFW data base.
	Number of listed fish passed upstream - **Unknown**	
	Hatchery stray rate	CWT data and spawning ground surveys
	Number wild fish used in broodstock - **see section 7.3**	Hatchery records
	Return timing of wild/ hatchery adults - /**October through November-Dec**	Hatchery records
	Adherence to spawning guidelines - **see sectiom 8.3**	Hatchery records Spawning guidelines

Minimize interactions with listed fish through proper rearing and release strategies	Juveniles released as smolts	Future Brood Document (FBD) and hatchery records
	Outmigration timing of listed fish / hatchery fish - **/May**	Hatchery records and historical natural out-migrant data
	Size and time of release - **17 fpp with April release (600,000); 600 fpp with May release (350,000)**	FBD and hatchery records
	Hatchery stray rates	CWT data and mark / unmarked ratios of adults
Maintain stock integrity and genetic diversity	Effective population size	Spawning guidelines
	Hatchery-Origin Recruit spawners	Spawning ground surveys
Maximize in-hatchery survival of broodstock and their progeny; and Limit the impact of pathogens associated with hatchery stocks, on listed fish	Fish pathologists will monitor the health of hatchery stocks on a monthly basis and recommend preventative actions / strategies to maintain fish health	Co-Managers Disease Policy Fish Health monitoring records
	Fish pathologists will diagnose fish health problems and minimize their impact	
	Vaccines will be administered when appropriate to protect fish health	
	A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings	

	Fish health staff will present workshops on fish health issues to provide continuing education to hatchery staff.	
Ensure hatchery operations comply with state and federal water quality standards through proper environmental monitoring	NPDES compliance	Monthly NPDES records

1.11) Expected size of program.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

2,300 adults

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry	Various Green River tribs	350,000
Fingerling		
Yearling	Soos Creek (09.0072)	600,000

*- Since the 1995 BY, there has been no changes to the programmed release numbers at the station and to the fry plants.

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

Between broodyears 1988 and 1997, the average smolt-to-adult survival rate was 3.23%. The escapement levels back to the hatchery between 1995 and 2000 (2001 not reconciled at this time (10/18/02)) were 10,827, 14,907, 7,512, 8,971, 8,201, and 43,989, respectively.

1.13) Date program started (years in operation), or is expected to start.

1901

1.14) Expected duration of program.

Ongoing.

1.15) Watersheds targeted by program.

Soos Creek (09.0072), Green River (09)

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

NA

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS

2.1) List all ESA permits or authorizations in hand for the hatchery program.

None.

2.2) Provide descriptions, status, and projected take actions and levels for ESA-listed natural populations in the target area.

2.2.1) Description of ESA-listed salmonid population(s) affected by the program.

- Identify the ESA-listed population(s) that will be directly affected by the program.

None

- Identify the ESA-listed population(s) that may be incidentally affected by the program.

Duwamish/Green River/Summer-Fall Chinook

The mean age ratio of chinook carcasses sampled on Green River spawning grounds in return years 1988 through 1997 was 5.5% age 2, 19.1% age 3, 64.4% age 4, 10.9% age 5 and 0.1% age 6. The adult sex ratio of sampled carcasses in 1999 was 52% male and 48% female. At age 3, 4, 5 and 6, adults average 60 to 80 cm., 80 to 95 cm., 85 to 100 cm. and 95 to 105 cm., respectively.

Most naturally-spawned Green River chinook migrate to salt water after spending only a few months in freshwater. Arrival of both hatchery and naturally-produced smolts in the estuary peaks in May, and after a few weeks, most begin moving to nearshore feeding grounds in Puget Sound and the Pacific Ocean. Sexually mature fish begin arriving back at the river mouth as early as July. The upstream migration peaks in late August to mid-

September. Spawning begins in early September, peaks in early October, and is generally complete by early November.

Adults spawn in the mainstem Green River from about river mile 25.4 in Kent to the City of Tacoma diversion dam at river mile 61. Approximately 70% of natural spawning occurs upriver from the mouth of Soos Creek (river mile 33.7). Tributary spawning occurs in the lower 4 miles of both Soos and Newaukum Creeks.

2.2.2) Status of ESA-listed salmonid population(s) affected by the program.

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds.

Critical and viable population threshholds under ESA have not been determined, however, the SASSI report (WDFW) determined this population (Duwamish/Green Summer/Fall Chinook) to be "healthy".

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

On average (return years 1987-98), each Green River natural spawner produces 2.33 adults returning to Washington waters. (WDFW Chinook Run-reconstruction Tables)

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Chinook escapements have exceeded the 5,800 fish goal in 9 of the past 12 years (1988-99), with a range of 2,476 to 11, 512. The 12-year average escapement is 7,598. (WDFW RR Tables)

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

The ratio of Soos Creek hatchery-origin chinook adults to mainstem Green River natural spawners averaged 33.4% in 7 years between 1989 and 1997 (WDFW coded-wire tag data). Small sample sizes (<4%) in 5 of these years, and the limited area sampled (river mile 33.8 to 41.4 only), make these data less than reliable when applied to the entire river.

The ratio of Soos Creek hatchery-origin Chinook adults to Newaukum Creek natural spawners averaged 23.3% in 9 years between 1989 and 1997 (WDFW coded-wire tag data) Sample rates averaged 30% per year.

2.2.3) Describe hatchery activities, including associated monitoring and evaluation

<u>and research programs, that may lead to the take of listed fish in the "target area," and provide estimated annual levels of take</u>

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

The release of fish as described in this HGMP could potentially result in ecological interactions with listed species. These potential ecological interactions are discussed in Section 3.5, and risk control measures are discussed in Section 10.11. Implementation of the program modifications provided in this HGMP, and the actions previously taken by the comanagers, are anticipated to contribute to the continued improvement in the abundance of listed salmonids.

Coho broodstock collection/spawning takes place between October and December overlapping the latter part of the chinook run.

- **Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish**.

None

Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

See "take" table

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

If take levels are projected to be exceeded for both juveniles and adults, WDFW will consult with NMFS in timely manner.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

None.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

3.3) Relationship to harvest objectives.

3.3.1) Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Fish from this program contribute to recreational and commercial fisheries in Puget Sound as well as fisheries in Canada.

3.4) Relationship to habitat protection and recovery strategies.

The comanagers' resource management plans for artificial production in Puget Sound are expected to be one component of a recovery plan for Puget Sound chinook under development through the Shared Strategy process. Several important analyses have been completed, including the identification of populations of Puget Sound chinook, but further development of the plan may result in an improved understanding of the habitat, harvest, and hatchery actions required for recovery of Puget Sound chinook.

3.5) Ecological interactions.

The program described in this HGMP interacts with the biotic and abiotic components of the freshwater, estuarine, and marine salmonid ecosystem through a complex web of short and longterm processes. The complexity of this web means that secondary or tertiary interactions (both positive and negative) with listed species could occur in multiple time periods, and that evaluation of the net effect can be difficult. WDFW is not aware of any studies that have directly evaluated the ecological effects of this program. Alternatively, we provide in this section a brief summary of empirical information and theoretical analyses of three types of ecological interactions, nutrient enhancement, predation, and competition, that may be relevant to this program. Recent reviews by Fresh (1997), Flagg et al. (2000), and Stockner (2003) can be consulted for additional information; NMFS (2002) provides an extensive review and application to ESA permitting of artificial production programs.

Nutrient Enhancement

Adults originating from this program that return to natural spawning areas may provide a source of nutrients in oligotrohic coastal river systems and stimulate stream productivity. Many watersheds in the Pacific Northwest appear to be nutrient-limited (Gregory et al. 1987; Kline et al. 1997) and salmonid carcasses can be an important source of marine derived nutrients (Levy 1997). Carcasses from returning adult salmon have been found to elevate stream productivity through several pathways, including: 1) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998); 2) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and 3) juvenile salmonids have been observed to feed directly on the carcasses (Bilby et al. 1996). Addition of nutrients has been observed to increase the production of salmonids (Slaney and Ward 1993; Slaney et al. 2003; Ward et al. 2003).

Predation – Freshwater Environment
Coho and steelhead released from hatchery programs may prey upon listed species of salmonids, but the magnitude of predation will depend upon the characteristic of the listed population of salmonids, the habitat in which the population occurs, and the characteristics of the hatchery program (e.g., release time, release location, number released, and size of fish released). The site specific nature of predation, and the limited number of empirical studies that have been conducted, make it difficult to predict the predation effects of any specific hatchery program. WDFW is unaware of any studies that have empirically estimated the predation risks to listed species posed by the program described in this HGMP.

In the absence of site-specific empirical information, the identification of risk factors can be a useful tool for reviewing hatchery programs while monitoring and research programs are developed and implemented. Risk factors for evaluating the potential for significant predation include the following:

<u>Environmental Characteristics.</u> Water clarity and temperature, channel size and configuration, and river flow are among the environmental characteristics that can influence the likelihood that predation will occur (see SWIG (1984) for a review). The SIWG (1984) concluded that the potential for predation is greatest in small streams with flow and turbidity conditions conducive to high visibility.

<u>Relative Body Size.</u> The potential for predation is limited by the relative body size of fish released from the program and the size of prey. Generally, salmonid predators are thought to prey on fish approximately 1/3 or less their length (USFWS 1994), although coho salmon have been observed to consume juvenile chinook salmon of up to 46% of their total length (Pearsons et al. 1998). The lengths of juvenile migrant chinook salmon originating from natural production have been monitored in numerous watersheds throughout Puget Sound, including the Skagit River , Stillaguamish River, Bear Creek, Cedar River, Green River, Puyallup River, and Dungeness River. The average size of migrant chinook salmon is typically 40mm or less in February and March, but increases in the period from April through June as emergence is completed and growth commences (Table 3.5.1). Assuming that the prey item can be no greater than 1/3 the length of the predator, Table 3.5.1 can be used to determine the length of predator required to consume a chinook salmon of average length in each time period. The increasing length of natural origin juvenile chinook salmon from March through June indicates that delaying the release hatchery smolts of a fixed size will reduce the risks associated with predation.

Table 3.5.1. Average length by statistical week of natural origin juvenile chinook salmon migrants captured in traps in Puget Sound watersheds. The minimum predator length corresponding to the average length of chinook salmon migrants, assuming that the prey

can be no greater than 1/3 the length of the predator, are provided in the final row of the table. (NS: not sampled.)

Watershed	Statistical Week										
	16	17	18	19	20	21	22	23	24	25	26
Skagit [1] 1997-2001	43.2	48.3	50.6	51.7	56.1	59.0	58.0	60.3	61.7	66.5	68.0
Stillaguamish [2] 2001-2002	51.4	53.5	55.7	57.8	60.0	62.1	64.2	66.4	68.5	70.6	72.8
Cedar [3] 1998-2000	54.9	64.2	66.5	70.2	75.3	77.5	80.7	85.5	89.7	99.0	113
Green [4] 2000	52.1	57.2	59.6	63.1	68.1	69.5	NS	79.0	82.4	79.4	76.3
Puyallup [5] 2002	NS	NS	NS	66.2	62.0	70.3	73.7	72.7	78.7	80.0	82.3
Dungeness [6] 1996-1997	NS	NS	NS	NS	NS	NS	NS	NS	77.9	78.8	81.8
All Systems Average Length	50.4	55.8	58.1	61.8	64.3	67.7	69.2	72.8	76.5	79.0	82.4
Minimum Predator Length	153	169	176	187	195	205	210	221	232	239	250

Sources:

[1] Data are from Seiler et al. (1998); Seiler et al. (1999); Seiler et al. (2000); Seiler et al. (2001), and Seiler et al. (2002)..

[2] Data are from regression models presented in Griffith et al. (2001) and Griffith et al. (2003).

[3] Data are from Seiler et al. (2003).

[4] Data are from Seiler et. (2002).

[5] Data are from Samarin and Sebastian (2002).

[6] Data are from Marlowe et al. (2001).

Date of Release. The release date of juvenile fish for the program can influence the likelihood that listed species are encountered or are of a size that is small enough to be consumed. The most extensive studies of the migration timing of naturally produced juvenile chinook salmon in the Puget Sound ESU have been conducted in the Skagit River, Bear Creek, Cedar River, and the Green River. Although distinct differences are evident in the timing of migration between watersheds, several general patterns are beginning to emerge:

1) Emigration occurs over a prolonged period, beginning soon after enough emergence (typically January) and continuing at least until July;
2) Two broad peaks in migration are often present during the January through July time period; an early season peak (typically in March) comprised of relatively

small chinook salmon (40-45mm), and a second peak in mid-May to June comprised of larger chinook salmon;
3) On average, over 80% of the juvenile chinook have migrated past the trapping locations after statistical week 23 (usually occurring in the first week of June).

Table 3.5.2. Average cumulative proportion of the total number of natural origin juvenile chinook salmon migrants estimated to have migrated past traps in Puget Sound watersheds.

Watershed	Statistical Week										
	16	17	18	19	20	21	22	23	24	25	26
Skagit [1] 1997-2001	0.61	0.64	0.68	0.73	0.76	0.78	0.83	0.86	0.90	0.92	0.94
Bear [2] 1999-2000	0.26	0.27	0.28	0.32	0.41	0.52	0.73	0.84	0.92	0.96	0.97
Cedar [2] 1999-2000	0.76	0.76	.0.76	0.77	0.79	0.80	0.82	0.84	0.87	0.88	0.90
Green [3] 2000	0.63	0.63	0.64	0.69	0.77	0.79	0.84	0.86	0.88	0.98	1.00
All Systems Average	0.56	0.58	0.59	0.63	0.68	0.72	0.80	0.85	0.89	0.94	0.95

Sources:

[1] Data are from Seiler et al. (1998); Seiler et al. (1999); Seiler et al. (2000); Seiler et al. (2001), and Seiler et al. (2002)..

[2] Data are from Seiler et al. (2003).

[3] Data are from Seiler et. (2002).

Release Location and Release Type. The likelihood of predation may also be affected by the location and type of release. Other factors being equal, the risk of predation may increase with the length of time the fish released from the artificial production program are commingled with the listed species. In the freshwater environment, this is likely to be affected by distribution of the listed species in the watershed, the location of the release, and the speed at which fish released from the program migrate from the watershed.

Coho salmon and steelhead released from western Washington artificial production programs as smolts have typically been found to migrate rapidly downstream. Data from Seiler et al. (1997; 2000) indicate that coho smolts released from the Marblemount Hatchery on the Skagit River migrate approximately 11.2 river miles day. Steelhead smolts released onstation may travel even more rapidly – migration rates of approximately 20 river miles per day have been observed in the Cowlitz River (Harza 1998). However, trucking fish to offstation release sites, particularly release sites located outside of the watershed in which the fish have been reared, may slow migrations speeds (Table 3.5.3).

Table 3.5.3. Summary of travel speeds for steelhead smolts for several types of release strategies.

Location	Release Type	Migration Speed (river miles per day)	Source
Cowlitz River	Smolts, onstation	21.3	Harza (1998)
Kalama River	Trucked from facility located within watershed in which fish were released.	4.4	Hulett (pers. comm.)
Bingham Creek	Trucked from facility located outside of watershed in which fish were released.	0.6	Seiler et al. (1997)
Stevens Creek	Trucked from facility located outside of watershed in which fish were released.	0.5	Seiler et al. (1997)
Snow Creek	Trucked from facility located outside of watershed in which fish were released.	0.4	Seiler et al. (1997)

Number Released. Increasing the number of fish released from an artificial production program may increase the risk of predation, although competition between predators for prey may eventually limit the total consumption (Peterman and Gatto 1978).

Predation – Marine Environment
WDFW is unaware of any studies that have empirically estimated the predation risks to listed species posed by the program described in this HGMP. NMFS (2002) reviewed existing information on the risks of predation in the marine environment posed by artificial production programs and concluded:

> "1) Predation by hatchery fish on natural-origin smolts or sub-adults is less likely to occur than predation on fry. Coho and chinook salmon, after entering the marine environment, generally prey upon fish one-half their length or less and consume, on average, fish prey that is less than one-fifth of their length (Brodeur 1991). During early marine life, predation on natural origin chinook, coho, and steelhead will likely be highest in situations where large, yearling-sized hatchery fish encounter sub-yearling fish or fry (SIWG 1984)."
>
> "2) However, extensive stomach content analysis of coho salmon smolts collected through several studies in marine waters of Puget Sound, Washington do not substantiate any indication of significant predation upon juvenile salmonids (Simestad and Kinney 1978)."
>
> "3) Likely reasons for apparent low predation rates on salmon juveniles, including chinook, by larger chinook and other marine predators are described by Cardwell and Fresh (1979). These reasons included: 1) due to rapid growth, fry

are better able to elude predators and are accessible to a smaller proportion of predators due to size alone; 2) because fry have dispersed, they are present in low densities relative to other fish and invertebrate prey; and 3) there has either been learning or selection for some predator avoidance."

Competition

WDFW is unaware of any studies that have empirically estimated the competition risks to listed species posed by the program described in this HGMP. Studies conducted in other areas indicate that this program is likely to pose a minimal risk of competition:

1) As discussed above, coho salmon and steelhead released from hatchery programs as smolts typically migrate rapidly downstream. The SIWG (1984) concluded that "migrant fish will likely be present for too short a period to compete with resident salmonids."

2) NMFS (2002) noted that "..where interspecific populations have evolved sympatrically, chinook salmon and steelhead have evolved slight differences in habitat use patterns that minimize their interactions with coho salmon (Nilsson 1967; Lister and Genoe 1970; Taylor 1991). Along with the habitat differences exhibited by coho and steelhead, they also show differences in foraging behavior. Peterson (1966) and Johnston (1967) reported that juvenile coho are surface oriented and feed primarily on drifting and flying insects, while steelhead are bottom oriented and feed largely on benthic invertebrates."

3) Flagg et al. (2000) concluded, "By definition, hatchery and wild salmonids will not compete unless they require the same limiting resource. Thus, the modern enhancement strategy of releasing salmon and steelhead trout as smolts markedly reduces the potential for hatchery and wild fish to compete for resources in the freshwater rearing environment. Miller (1953), Hochachka (1961), and Reimers (1963), among others, have noted that this potential for competition is further reduced by the fact that many hatchery salmonids have developed different habitat and dietary behavior than wild salmonids." Flagg et al (2000) also stated "It is unclear whether or not hatchery and wild chinook salmon utilize similar or different resources in the estuarine environment."

4) Fresh (1997) noted that "Few studies have clearly established the role of competition and predation in anadromous population declines, especially in marine habitats. A major reason for the uncertainty in the available data is the complexity and dynamic nature of competition and predation; a small change in one variable (e.g., prey size) significantly changes outcomes of competition and predation. In addition, large data gaps exist in our understanding of these interactions. For instance, evaluating the impact of introduced fishes is impossible because we do not know which nonnative fishes occur in many salmon-producing watersheds. Most available information is circumstantial. While such information can identify where inter- or intra specific relationships may occur, it does not test mechanisms explaining why observed relations exist. Thus, competition and predation are usually one of several plausible hypotheses explaining observed results."

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

Soos Creek Hatchery is supplied by surface water from Soos Creek. Water is withdrawn via 4 pumps at the hatchery site. Pumps produce 13,500 gallons per minute (gpm). In addition, a small spring water supply (50 gpm) can be utilized in the incubation building. Soos Creek responds quickly to heavy rainfall and is prone to rapid fluctuations. Heavy bed loads are due to extensive watershed development. Winter floods are becoming an increasingly common occurrence due to continued watershed development.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

The hatchery intake utilizes .125" x .125" mesh drum screens. Adult chinook are normally passed upstream of the hatchery to spawn naturally above the hatchery intake. Hatchery effluent shall meet or exceed NPDES permit standards for discharge of pond cleaning waste or pond drawdown.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Broodstock are collected in an in-stream trap situated in Soos Creek. The trap pond is the natural stream channel and measures approximately 150' x 200'. It is defined by a lower, semi-temporary weir, ladder, and "V" entry way and an upper semi-temporary weir.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

None

5.3) Broodstock holding and spawning facilities.

Broodstock are held in the trap pond. Adults are seined, sorted, killed and spawned at pondside.

5.4) Incubation facilities.

Incubation utilizes 160 shallow troughs and 56 deep troughs.

5.5) Rearing facilities.

The facility utilizes eight 10" X 80' raceways, eight 17.5' X 95' concrete rearing ponds and three .14 acre asphalt ponds

5.6) Acclimation/release facilities.

All station releases are from individual ponds into the creek. Most releases are forced releases of smolts in late May or early June.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

In the past 12 years:

1. Heavy debris loads cause the pump intake screens to become plugged frequently during flood events.

2. Flood risks limit the use of eight, low lying, standard rearing ponds as the flood waters often inundate them and allow the premature release of the fish.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

The hatchery is equipped with a backup generator and adequate fuel supply in the event of a power outage. Two persons are on rotating standby status year around in the event of a problem. An upgraded alarm system is designed to detect changes in flow and power status. The risk of disease transmission shall be limited by using effective theraputents, as prescribed and in a timely manner.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

This stock originated from adults trapped in the Green River.

6.2) Supporting information.

6.2.1) History.

The Soos Creek Hatchery coho originated from the Green River. Some additional stocks were occasionally imported in the early days of the hatchery operation but their contribution was not significant. The program has depended upon volunteer returns for many decades.

6.2.2) Annual size.

2,300 adults.

6.2.3) Past and proposed level of natural fish in broodstock.

Unknown in past. See section 7.3

6.2.4) Genetic or ecological differences.

None known.

6.2.5) Reasons for choosing.

Native stock.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

NA

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Adults.

7.2) Collection or sampling design.

Returning adults are trapped, volitionally, with an in-stream trap. Returns occur between October and December with peak spawning in November. If prescribed, adults are individually counted upstream, past the weir, to spawn naturally. Except when hand counted, adults normally have no access past the hatchery. Numerous adults stop short of entering the weir and spawn in the gravel bars downstream of the hatchery.

7.3) Identity.

All coho returning to the Soos Creek Hatchery may be selected as broodstock

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

2,300 adults (1,150 males and 1,150 females).

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Year	Adults Females	Males	Jacks	Eggs	Juveniles
1988					
1989					
1990					
1991					
1992					
1993					
1994					
1995	1,757	1,732	8	3,268,000	
1996	1,766	1,825	53	2,862,000	
1997	2,231	2,292	22	3,178,000	
1998	2,444	2,444	7	3,380,000	
1999	1,401	1,620	15	2,939,800	
2000	1,333	1,415		2,906,000	
2001	0*				

* - Broodstock numbers for 2001 are being checked (reconciled) at this time (01/17/03).

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

Unspawned adults are either donated to local food banks or sold to the carcass buyer for processing for human consumption or sent upstream to spawn naturally. When mass marked fish return, only un-marked fish will be passed upstream.

7.6) Fish transportation and holding methods.

NA

7.7) Describe fish health maintenance and sanitation procedures applied.

Standard fish health protocols, as defined in the Co-Manager Fish Health Manual (WDFW 1996), are adherred to.

7.8) Disposition of carcasses.

Spawned carcasses are utilized for nutrient enhancement or sold to a carcass buyer for rendering into meal. Unspawned adults are either donated to local food banks or sold to the carcass buyer for processing for human consumption. Pond mortality is utilized for nutrient enhancement purposes.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

NA (what few naturally produced chinook are encountered will be passed upstream)

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

Females are chosen randomly from ripe fish. Depending upon the magnitude of the returns, the aim is to spawn all ripe females each spawn day. Males are selected randomly. Matings are 1:1. About 1% of males used are "jacks". If female numbers exceed hatchery need, eggs are taken randomly from later spawning females, to represent that portion of the run, and the remaining females are "surplused", i. e., removed from the breeding pool.

8.2) Males.

Males are selected randomly. Matings are 1:1, but if a male killed for spawning is not fully ripe or has very little sperm, another male is used to assure fertilization of the eggs. About 1% of males used are "jacks".

8.3) Fertilization.

Matings are 1:1, but if a male killed for spawning is not fully ripe or has very little sperm, another male is used to assure fertilization of the eggs. The eggs from 1 female are collected in a bucket. The sperm from one male, or two, is expressed directly onto the eggs and mixed gently. The mix is allowed to sit for 30 to 60 seconds and then pooled in a common bucket with other eggs. They then go into the hatchery.

8.4) Cryopreserved gametes.

NA

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

NA

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

See 7.4.2 for eggs taken.
Green egg to fry survival: Average is 86.5%; Range is 82.7 to 89.7%

9.1.2) Cause for, and disposition of surplus egg takes.

On occasion, a surplus of eggs results from inaccurate green egg sampling at the time of egg take. Extra eggs are normally taken as a safeguard against potential incubation loss. Surplus fry, less than or equal to 10% are normally reared as part of the programmed releases. Additional excess was commonly released as unfed fry or short-term reared fry. In recent years, a greater emphasis has been placed on not exceeding the program release goals.

9.1.3) Loading densities applied during incubation.

Eggs are eyed in shallow troughs 20,000 to 25,000 per basket. Egg are hatched in deep troughs at about 26,000 per section.

9.1.4) Incubation conditions.

Eggs are hatched with Vexar substrate using ambient Soos Creek water. Water quality has deteriorated due to heavy silt load. Accumulated silt is flushed periodically from the trough sections.

9.1.5) Ponding.

Ponding occurs when the fry have achieved >95% button-up status. Ponding is forced and occurs between late December and mid-January.

9.1.6) Fish health maintenance and monitoring.

Egg fungus is controlled with a 15 minute formalin drip at 100 parts per million (ppm), 5 days per week, until the eggs are shocked and picked. Dead eggs are removed with the aid of a "Jen-sorter" power egg picker. Coagulated yolk-sac incidence level is low.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

NA

9.2) <u>Rearing</u>:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available..

Fry to smolt: Average is 95.4%; Range is 88.8 to 99.3%

9.2.2) Density and loading criteria (goals and actual levels).

Loading goals conform to guidelines set out in Fish Hatchery Management (Piper, 1982). Maximum loading goals, in terms of pounds per gallons per minute (lbs/gpm) at release, equates to 1.5 x fish length in inches. Maximum densities, in terms of lbs / cubic foot of rearing space, equates to .3 x fish length in inches.

9.2.3) Fish rearing conditions

All ponds receive ambient water from Soos Creek. Incoming oxygen levels are saturated, but are not normally monitored. Due to heavy silt loads the ponds are vacuumed frequently (weekly or as-needed). Normal loss is vacuumed to the pollution abatement pond. Losses derived from disease epizootics are sent to a sanitary landfill.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

Not available.

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

Not available.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Feed type is a salmon formulation of dry crumbles or pellets. Feed brand varies with the contract price. Fish are fed daily at a rate approximating 2% B.W./day. The maximum feed rate goal is approximately .1 lb feed per gpm inflow. Feed conversions depend upon the diet and formulation but range between .8 - 1.1: 1.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

Ponds are vacuumed weekly or as-needed. Fish Health Specialists make scheduled visits to check on fish health. Medications or alternate management plans derive from these checks. When emptied, all ponds are cleaned, air dried and sun-sanitized, if possible.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

Not applicable.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

None

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

NA

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry	350,000	600	May	Green R.
Fingerling				
Yearling	600,000	17	April	Soos Creek

10.2) Specific location(s) of proposed release(s).

Stream, river, or watercourse: Soos Creek (09.0072)
Release point: Soos Creek, RM .8 (09.0072)
Major watershed: Green River
Basin or Region: Puget Sound

10.3) Actual numbers and sizes of fish released by age class through the program.

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1988								
1989								
1990								

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1991								
1992								
1993								
1994								
1995			506,560	558	127,200**	165	106,000 736,000	27* 16
1996			717,700	554	216,400**	227	120,000 454,750	21* 17
1997			248,100	588			583,000	20
1998			301,015	421			555,800	17
1999			328,176	516	217,800**	175	589,500	16
2000							675,805	16
2001			349,872	591			601,556	18
Average			408,571	538	187,133	189	491,379	19

* - Involuntary release due to a flood.

** - Surplus coho

10.4) Actual dates of release and description of release protocols.

Most fish are forced released in mid to late May.

10.5) Fish transportation procedures, if applicable.

NA

10.6) Acclimation procedures.

Fish are reared their entire lifetime on Soos Creek water.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

The 1996 brood was the first to be 100% mass marked. Soos Creek is a "double index" hatchery and each year 45,000 fish are adipose-fin clipped/coded-wire tagged prior to release and another 45,000 are just coded-wire tagged.

10.8) Disposition plans for fish identified at the time of release as surplus to programmed

or approved levels.

In the past, significant numbers of surplus fish were not reared full term but were planted as fry. In the future, egg takes will be carefully managed to minimize the likelihood of surplus eggs or fry.

10.9) Fish health certification procedures applied pre-release.

Routine fish health inspection by the Area Fish Health Specialist.

10.10) Emergency release procedures in response to flooding or water system failure.

Depending upon circumstances, release fish with either the highest probability of surviving to adulthood or the fish with the highest probability of sustaining catastrophic loss if held at the hatchery.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

To minimize the risk of residualization and impact upon natural fish, hatchery yearlings are released in April as smolts. All fish released will be mass marked.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

The comanagers conduct numerous ongoing monitor programs, including catch, escapement, marking, tagging, and fish health testing. The focus of enhanced monitoring and evaluation programs will be on the risks posed by ecological interactions with listed species. WDFW is proceeding on four tracks:

1) An ongoing research program conducted by Duffy et al. (2002) is assessing the nearshore distribution, size structure, and trophic interactions of juvenile salmon, and potential predators and competitors, in northern and southern Puget Sound. Funding is provided through the federal Hatchery Scientific Review Group.

2) A three year study of the estuarine and early marine use of Sinclair Inlet by juvenile salmonids is nearing completion. The project has four objectives:

a) Assess the spatial and temporal use of littoral habitats by juvenile chinook throughout the time these fish are available in the inlet;
b) Assess the use of offshore (i.e., non-littoral) habitats by juvenile chinook;

c) Determine how long cohorts of juvenile chinook salmon are present in Sinclair inlet;
d) Examine the trophic ecology of juvenile chinook in Sinclair Inlet. This will consist of evaluating the diets of wild chinook salmon and some of their potential predators and competitors.

Funding is provided by the USDD-Navy.

3) WDFW is developing the design for a research project to assess the risks of predation on listed species by coho salmon and steelhead released from artificial production programs. Questions which this project will address include:

a) How does trucking and the source of fish (within watershed or out of watershed) affect the migration rate of juvenile steelhead?
b) How many juvenile chinook salmon of natural origin do coho salmon and steelhead consume?
c) What is the rate of residualism of steelhead in Puget Sound rivers?

Funding needs have not yet been quanitifed, but would likely be met through a combination of federal and state sources.

4) WDFW is assisting the Hatchery Scientific Review Group in the development of a template for a regional monitoring plan. The template will provide an integrated assessment of hatchery and wild populations.

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

See Section 11.1.1.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Risk aversion measures will be developed in conjunction with the monitoring and evaluation plans.

SECTION 12. RESEARCH

12.1) Objective or purpose.

None

12.2) Cooperating and funding agencies.

12.3) Principle investigator or project supervisor and staff.

12.4) Status of stock, particularly the group affected by project, if different than the

stock(s) described in Section 2.

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.

12.6) Dates or time period in which research activity occurs.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

12.8) Expected type and effects of take and potential for injury or mortality.

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

12.10) Alternative methods to achieve project objectives.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the foregoing information is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Chinook ESU/Population: Puget Sound Chinook Activity: Soos Creek Coho Program				
Location of hatchery activity: Soos Creek Hatchery Dates of activity: October-May Hatchery program operator: WDFW				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)				
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)		Unknown	Unknown	
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.